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PINCHER CREEK EAST AREA
LEVEL III
LAND IRRIGABILITY CLASSIFICATION

Prepared for:

PLANNING DIVISION
ALBERTA ENVIRONMENT

Prepared by:

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ABSTRACT

The purpose of this project is to conduct a Land Irrigability Classification for the Pincher Creek East area. This area is comprised of 93,010 acres within the Municipal District of Pincher Creek (No. 9). It includes lands within the townships of 5-28, 6-28, 6-29, 6-30, 7-28, 7-29, 8-28, and 8-29 W4. The classification was conducted according to the standards for Level III intensity and included field soil mapping, soil profile drilling and sampling, laboratory analysis of the samples, evaluation of the data, and classification of the soil irrigation potential.

The study area lies within the Cardston Plain, Three Rivers Plain and the Porcupine Hills physiographic divisions. The plains are generally very gently to moderately sloping. The topography in the hills region is controlled by sandstone, and to a lesser degree, shale bedrock. The soil parent material on the plains is comprised principally of glacial lacustrine or lacustro-till deposits which both have high clay contents (45-70% clay). Clay to clay loam textured till or lacustro-till are the dominant soil parent materials in the hills area. Coarser textured glacial fluvial deposits are found in Township 7-29 W4 adjacent the Oldman River.

The continental climate of the area is characterized by cold winters and hot summers. Average annual precipitation is approximately 545 mm. Chinook winds are common in the Pincher Creek area. The majority of the study area is under dryland agriculture. The native pasture land in the area is typically fescue grass prairie.

The Calcareous and Orthic subgroups of the Black and, to a lesser degree, Dark Brown great groups are dominant in the study area. Eroded phases of these soils comprised 32% of the soils investigated. Other Chernozemic subgroups were also noted together with soils in the Gleysolic and Regosolic Orders.

The majority of the study area (70 percent) was rated as irrigable within land classes 2 to 4. Class one land was not mapped in the study area. Sixty percent of the study area was rated as land class 3 with moderately severe soil and topographic limitations. Soil limitations for irrigation were typically a result of fine soil textures (clayey to heavy clayey), high lime content (calcareous profile development) and/or topsoil loss due to wind erosion. Approximately 7 percent of the study area was rated class 2, with only moderate limitations. A majority (76 percent) of this class 2 land is found in Townships 7-29, 8-28, and 7-28.

The majority of the soils in the block would require light, frequent applications of irrigation water to minimize surface runoff (hence erosion) and downslope salinization due to lateral movement of water.

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1.0 INTRODUCTION

1.1 BACKGROUND

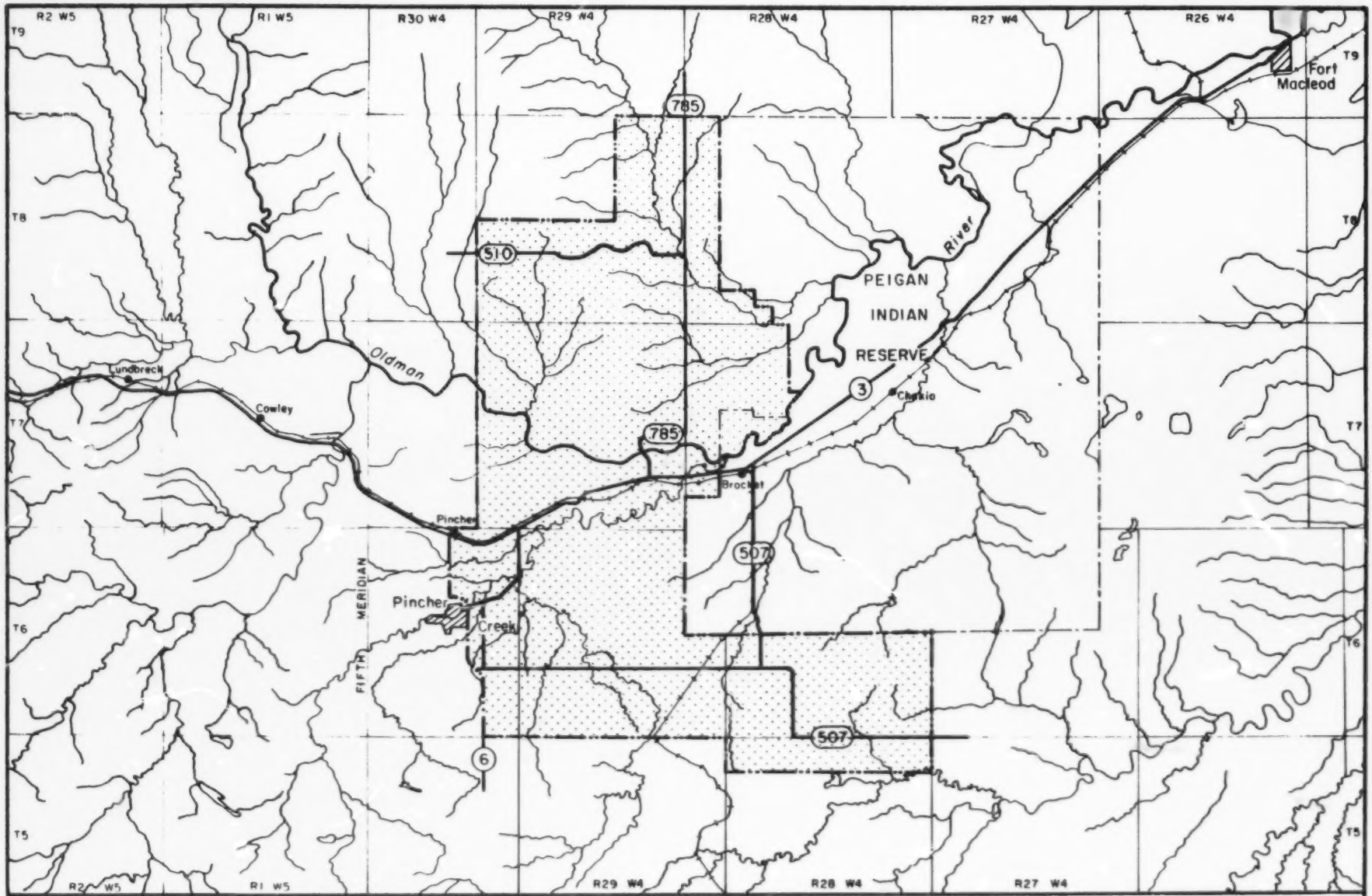
The Planning Division of Alberta Environment requested Hardy Associates (1978) Ltd. to conduct a Land Irrigability Classification for the Pincher Creek East area. The classification area is within a block that includes lands in Townships 5-28, 6-28, 6-29, 6-30, 7-28, 7-29, 8-28, and 8-29 W4 (Figure 1).

Existing sources of relevant information were incorporated into the classification, and included Level II irrigability land classifications which were provided by Alberta Agriculture, and federal soil survey information for the Pincher Creek/Crowsnest Pass municipalities (Walker and Brierley, 1985).

1.2 PURPOSE OF THE PROJECT

The purpose of the project is to investigate and inventory the suitability of lands for irrigation within the block east of Pincher Creek for the following purposes:

- identify and rate lands for their suitability for irrigation;
- describe and characterize the land within the area investigated;
- identify potential impacts of irrigation which may occur; and
- recommend appropriate soil and water management practices.



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LOCATION MAP OF PINCHER CREEK EAST STUDY AREA

FIG. 1

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1.3 SCOPE OF THE PROJECT

The classification is a Level III, medium intensity investigation, as outlined in the project terms of reference and defined by Alberta Agriculture (1983).

The overall investigation was managed by P.G. Karkanis, of Alberta Agriculture. Hardy Associates (1978) Ltd. was responsible for drilling, logging, sampling, land classification and cartography. Analytical analysis of soil samples was subcontracted to Chemex Laboratories Ltd. and Lakeside Research.

Soil descriptions and terminology are consistent with the Canada Soil Survey Committee (1978) and Dumanski (1978).

2.0 METHODS

The classification was conducted at a Level III intensity as described by Alberta Agriculture (1983).

2.1 FIELD INVESTIGATION

In compliance with the terms of reference, verbal authorization and consent was received from land owners or tenants prior to the commencement of the field investigation. The field program consisted of two components:

- mapping and checking; and
- drilling, logging and sampling.

Stereo air photos were reviewed prior to field checking. Soil and land irrigability classification boundaries were delineated and confirmed in the field. Areas excluded from detailed examination because of their obvious nonirrigable status included coulees, wetlands and steeply sloped bedrock ridges. On average a minimum of 4 holes were drilled and sampled per section of potentially irrigable land as required in the terms of reference. Combined with recent Agriculture Canada soil survey information (Walker and Brierley, 1985), the average inspection density was 8 sites per potentially irrigable section.

Inspection sites, soil and topographic boundaries and cultural features were plotted onto a 1:20,000 scale township photo. Site data was recorded onto field sheets and included parameters such as soil classification, horizon sequence,

depth and texture, parent material, drainage, vegetation, and subgroup and parent material distribution within the landscape.

During the field checking, classification boundaries were delineated, and representative drilling sites selected. the drill sites were plotted onto the 1:20,000 scale township photo and forwarded to the drilling team.

Drilling was carried out between September 25 and November 4, 1985 using a mobile B-31 comparable drill mounted on a one ton 4 X 4 truck. A total of 405 holes were drilled. Three holes per section were drilled, logged and sampled to 2 m. One hole per section was drilled, logged and sampled to 4.5 m. A thin walled 3" diameter tube was pushed to 2 m to collect relatively undisturbed samples. Holes deeper than 2 m were augered. Samples and horizons were logged onto sheets provided by Alberta Agriculture.

At least 3 samples were collected, representing the A, B and C horizons by the driller from each site. Additional samples were taken below 2 m on the augered holes. The samples were placed in clean plastic bags, labelled and forwarded to Chemex Laboratories Ltd. in Calgary for analysis.

2.2 LABORATORY ANALYSIS

Each sample was dried, ground and analyzed using standard analytical techniques for salinity which included pH, Electrical Conductivity (E.C.), saturation percent, and soluble cations required for Sodium Adsorption Ratio (SAR) calculation. Ten percent of the samples were selected for

mechanical analysis. An additional 10% of the samples were split and forwarded to Lakeside Research for checks of analytical accuracy. Laboratory data are presented under a separate cover.

2.3 DATA EVALUATION AND IRRIGABILITY CLASSIFICATION

Drill logs, analytical chemistry and field sheets were used in the evaluation of the soil delineations. Each mapped soil delineation was subdivided into its various soil subgroups. A basic soil rating (BSR) was calculated for each soil subgroup profile occurring within a delineation. The soil subgroup BSR was proportioned according to its extent of occurrence within the landscape, and modified where applicable because of salinity. The partial soil ratings index for each subgroup profile were added to give the final soil rating and category.

The topographic category is assigned on the basis of surface features, dominant or limiting slope class, stoniness and brush or tree cover. These affect the ease of irrigation, the size and shape of the field as well as the suitability and type of irrigation system that can be used. The soil and topographic ratings are then combined to assign the appropriate Irrigability Land Class.

2.4 MAP CONVENTIONS

Map symbols are consistent with Alberta Agriculture (1983). For land topographically suited for irrigation the map symbol is composed of two component parts. The landscape description includes the soil subgroups, parent material, texture,

topography and surface expression, and soil chemistry. The interpretive land class symbol is derived from the landscape description.

It is important to note that the soil, landscape and limitation annotations are a simplification of the real landscape in that only dominant and highly contrasting members are noted on the map.

The soil taxonomy descriptions are usually a complex, to a maximum of three soil subgroup profiles. Soil and topographic limitations in the land class symbol are kept to a maximum of the three most limiting factors. Soil and topographic limitations are displayed in order of importance and follow a single drainability class.

3.0 DESCRIPTION OF THE PROJECT AREA

3.1 GEOGRAPHIC LOCATION, SIZE AND ACCESS

The study area is within the block of townships 5-28, 6-28, 6-29, 6-30, 7-28, 7-29, 8-28, and 8-29 W4 (Figure 1). This area is bounded to west by the town of Pincher Creek, to the north by the Municipal District of Willow Creek and to the east by the Peigan Indian Reserve. The study area includes 37,630 ha (93,010 acres) within the Municipal District of Pincher Creek (No. 9). The area is accessed by secondary roads 507, 785 and provincial highways #3 and #6

3.2 PHYSIOGRAPHY, RELIEF AND SURFACE DRAINAGE

The study area lies within the Cardston Plain, Three Rivers Plain and Porcupine Hills physiographic divisions in order of dominance (Pettapiece, 1985). The plains are generally very gently to gently undulating whereas the hills are generally gently to moderately sloping. Elevations range from approximately 3750 m a.s.l. in the Plains area to 4000 m a.s.l. in the northern portion of the study area. General landscape slope north of the Oldman River is NW to SE whereas south of the Oldman River it is SW to NE. Drainage is into the Oldman River via Pincher, Beaver and Indianfarm creeks and numerous minor streams.

3.3 SURFICIAL AND BEDROCK GEOLOGY

Alberta Agriculture (1983) does not recognize glacial lacustrine (i.e. lacustrine material deposited in a periglacial environment) as a distinct soil parent material. The dominant material mapped as lacustrine in the study area is, however, glacial lacustrine. For consistency with Alberta Agriculture (1983) the term lacustrine is used throughout this report to apply to glaciolacustrine deposits.

The surficial deposits on the plains region area comprised mainly of lacustrine and lacustro-till materials (Alley and Harris 1974; Walker and Brierley, 1985). Lacustrine deposits from glacial lakes formed between ridge features along the southern edge of 5-28, 6-29 and 6-30 and ridges in the northeast of 6-29 and in the north of 7-29 characterize the plains regions. Lacustrine materials are generally uniform and stone free except for the soil surface which is typically slightly stony, probably a result of stone and cobble ice rafting. Less uniform deposits made under fluctuating water conditions (viz. lacustro-till) are found in broad bands along the plain edge where very gently undulating topography meets bedrock controlled ridges. Lacustro-till deposits are characterized by a slightly to moderately stony surface. Coarser textured glaciofluvial deposits are found in Tp 7-29 adjacent the Oldman river. Basal glacial till deposits are found on ridges and plateaus throughout the study area.

Ice margined melt water channels occur throughout the area. The largest of these is found in the northwest of Tp 7-29 and is up to 0.9 km across and approximately 70 m deep. Numerous

smaller channels occur throughout the area and are particularly common in Tps 8-29, 8-28 and 7-29. These channels are 50-200 m wide.

The plains region of the study area lies on the Willow Creek formation of the Paleoscene and upper Cretaceous age (Green 1979). This formation is a succession of nonmarine pale grey fine grained calcareous sandstone; grey, green and pink bentonitic mudstone with abundant white weathering calcareous concretions; and thin limestone beds. Approximately the northern 1/3 of the study area lies on the Porcupine Hills formation which is comprised of nonmarine pale grey, thick bedded, cherty, calcareous sandstone and pale grey calcareous mudstone (Green 1970). Bedrock outcrops are common in the ridge areas of Tps 6-28, 6-29, 7-29, 8-29, and 8-28. Bedrock depths are greater than 4.5 m except on ridges and plateaus.

3.4 CLIMATE AND NATIVE VEGETATION

The climate of the area is a continental type with cold winters (mean January temperature, Pincher Creek -9.5°C and hot summers (mean July temperature, Pincher Creek 16.5°C, Table 1). Annual precipitation is 543.4 mm at Pincher Creek (Table 2), June being the wettest month with 15.5% of the annual precipitation. Winds at Pincher Creek are dominantly from the west and west-southwest (Tables 3, and 4). Chinook winds are common; the area receives in excess of 30 chinook wind days per year (Strong and Leggat, 1981). The area is located in the Fescue Grass Ecoregion (Strong and Leggat 1981). The dominant native vegetation is rough fescue (Festuca scabrella) with secondary quantities of Parry oat grass (Danthonia parryi), june grass (Koeleria macrantha),

TABLE 1*

MEAN DAILY TEMPERATURES
(°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Pincher Creek	-9.5	-4.7	-2.4	3.7	9.4	13.2	16.5	15.5	11.4	6.6	-0.9	-5.5	4.4
Pincher Creek Town	-10.2	-5.2	-2.6	3.4	9.2	13.3	16.5	15.4	10.9	6.1	-1.5	-6.1	4.1

TABLE 2*

MEAN MONTHLY PRECIPITATION
(mm)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Pincher Creek	32.6	25.7	29.6	61.6	71.8	84.2	45.1	50.6	52.7	28.1	31.0	30.4	543.4

*Reference: Environment Canada, 1982.

TABLE 3*

PERCENTAGE FREQUENCY OF WIND DIRECTION
(Partial List)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WSW	14.7	15.8	18.7	21.0	17.7	20.0	16.8	17.5	19.0	22.4	17.8	15.2	18.1
W	39.1	42.2	34.8	31.6	32.7	33.1	30.1	31.8	34.0	43.0	40.9	42.8	36.3
Calm	15.0	13.9	13.8	11.7	11.7	14.1	15.7	14.6	14.2	10.4	14.4	15.1	13.7

TABLE 4*

MEAN WIND SPEED
(Km/hour)
(Partial List)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WSW	36.1	34.1	29.4	30.3	26.4	26.3	22.6	23.5	25.6	31.2	30.8	32.9	29.1
W	35.7	33.0	28.6	27.7	24.5	24.0	21.7	21.4	24.4	30.2	31.2	32.6	27.9

* Reference: Environment Canada, 1982.

chickweed (Stellaria sp.), sticky geranium (Geranium viscosissimum), lupines (Lupinus sp.), yellow bean (Thermopsis rhombifolia), sage (Artemesia sp.), yarrow (Achillia sp.), bedstraw (Galum sp.), and fleabanes (Erigeron sp.). Areas of undisturbed native vegetation are limited to rough broken areas such as coulees, riverbanks and on undeveloped road allowances.

3.5 CURRENT LAND USE

Land use within the study area is approximately as follows: 72% dryland agriculture, 1% irrigation agriculture, 10% native pasture land, and 1% wetland, water bodies and river valley bottoms. About 16% of the area is occupied by coulees, meltwater channels, ridges, river banks and other steep features. Of the dryland farm areas, approximately 50% of the land is in fallow. Strip cropping is practiced in an effort to protect against wind erosion, preserve moisture and control weeds. Commonly grown dryland crops are hard red spring wheat, winter wheat, duram wheat and barley. Alfalfa is a common forage crop.

The small amount of land under irrigation currently uses the center pivot irrigation system.

Pasture lands are generally restricted to moderately sloping areas and on ridges and plateaus.

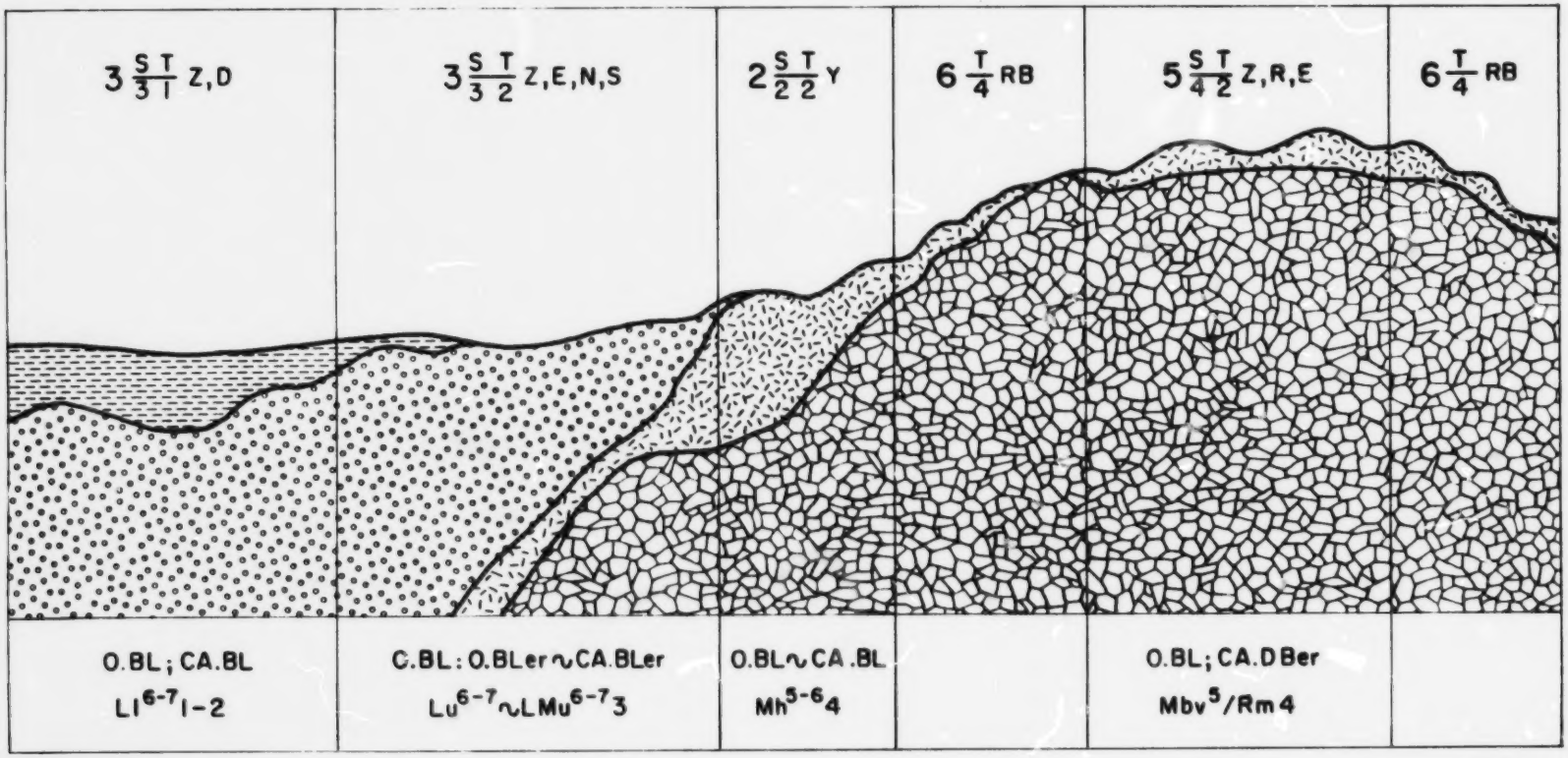
4.0 SOIL DEVELOPMENT PROCESS AND LANDSCAPE FEATURES

Orthic Black and Dark Brown Chernozems are the two zonal soils in the classification area. Other soils which occur in the area have been affected by processes such as erosion, gleying, leaching or chemical accumulation. The resulting soil types include the Gleysolic and Regosolic soil orders in addition to other Chernozemic subgroups. Calcareous Chernozemic profiles occur more frequently than do Orthic Chernozemic profiles in the study area.

4.1 GENETIC MATERIALS AND TOPOGRAPHY

Although lacustrine, lacustro-till and glacial till parent materials have been mapped as discrete map units, these soil parent materials often are intermixed in a particular landscape. The study area was affected by both continental and mountain glaciation processes (Alley and Harris, 1974). In townships 6-28 and 6-29 lacustrine and lacustro-till materials are often intermixed possibly as a result of superglacial ponding and deposition. As a result areas of lacustro-till outcrop within areas indicated to be lacustrine. From a practical stand point this occurrence is of little consequence since both lacustrine and lacustro-till materials are characterized by texture as in the range of clay to heavy clay.

Figures 2 and 3 show some typical landscape profiles within the study area.



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TYPICAL LANDSCAPE PROFILES

FIG. 2

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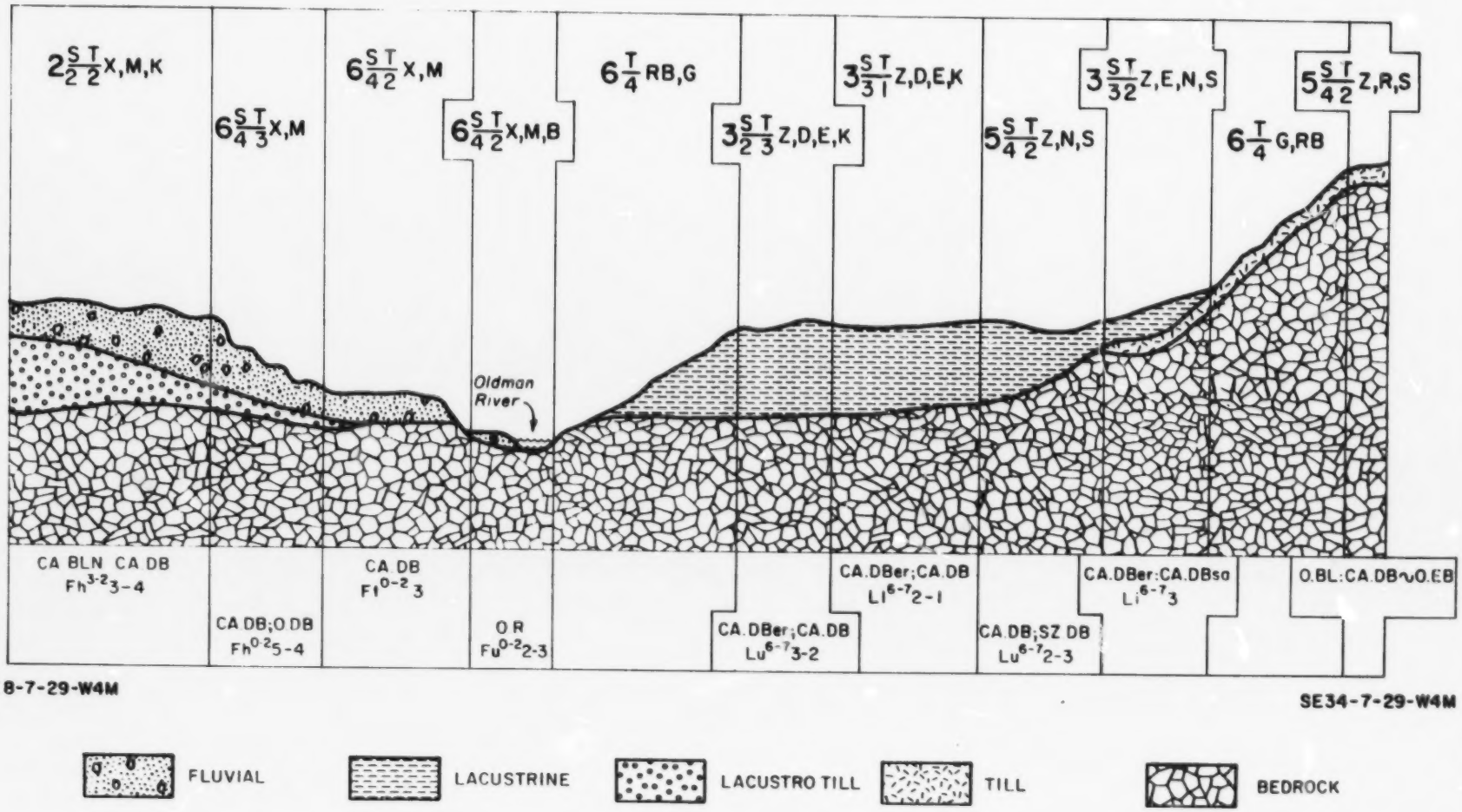

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TYPICAL LANDSCAPE PROFILES

FIG. 3

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In areas of fluvial-lacustrine veneers (Tp 7-29), wind erosion may have removed the coarser textured veneer from the underlying heavier texture material. As a result, there may be some heavier textured surface soils. This is indicated as a range of parent materials on the map.

In the pastureland areas in northeast Tp 6-29 and northwest Tp 8-28 pockets of coarser material occur within the glacial till. This is indicated as a range of textures on the maps.

Within the topographic delineation of a particular map unit, there may be inclusions or significant amounts of other slope classes other than the one or two indicated on the map. Either the dominant or most limiting topographic class or classes are expressed. As with genetic materials, it is not always possible to delineate these areas at the Level III scale of mapping.

In map units where significant amounts of contrasting soils or topographic classes occur (other than the dominant member), both dominant and significant members of the complex map unit have been included in the calculation of the irrigability rating.

4.2 SOIL DEVELOPMENT PROCESS

The catena is the sequence of soils that develop on a slope as a result primarily of hydrological differences along the slope. The soil taxonomy and abundance designation on the map usually imply a catenary sequence. Figure 4 shows two types of catenas that may occur. These are idealized and not every subgroup will necessarily occur, but the catenary components

are found in most delineations. Drainage, cultivation practices or erosion may be responsible for the absence or presence of some subgroups in a landscape.

The typical Orthic Black Chernozem found in the study area has the following horizon sequence: Ap (or Ah in native pastureland), Bm, Ck. The A horizon is the topsoil and is characterized as being black in colour due to organic enrichment from the decomposition mainly of grass roots, leaves and stems. On undisturbed sites the Ah horizon is, on average, 18-24 cm thick, and in cultivated fields in the nearly level areas in Twps 5-28, 6-28, 6-29, and 6-30, 20-28 cm thick. In the northern townships (7-28, 7-29, 8-29) topsoil depths in cultivated fields are; on average, 15-18 cm. The thickness of the A horizon decreases on steeper slopes and knolls. Chernozemic soils with Ap horizons less than 15 cm thick or Ah horizons less than 10 cm thick are classified as eroded phases of the Chernozem (C.S.S.C. 1978).

The Bm horizon is usually reddish brown to dark yellowish brown in colour. It has not been altered significantly by any process other than the leaching of lime and oxidation of iron. On some soils there may be a weakly expressed Bt horizon, that is, a B horizon that has been enriched by eluviated clay. The Bm horizon thickness varies depending on slope position and steepness. On relatively level areas the Bm horizon typically extends to a depth of 30-45 cm. On steeply sloping areas the Bm horizon may be as thin as 5 cm. The Ck horizon underlies the Bm horizon.

The Ck horizon is basically unaltered parent material that has been very slightly modified by the enrichment of lime leached from the upper horizon but not modified enough for it to be considered a Cca horizon. Typically the colour of the Ck horizon is yellowish brown to light olive brown. The presence of gypsum crystals and/or coal specks is common at depths below 1 m, particularly in lacustro-till deposits.

Cca horizons are common in Chernozemic profiles but are not common in the study area. When present they occur between the Bm and Ck horizons. The Cca horizon is characterized by its very pale brown to light yellowish brown colour, a result of lime enrichment.

Figure 4a shows the relationship of soil subgroup profiles on a level to nearly level undulating landscape (C.S.S.C. 1978 slope classes 1 and 2). On most well drained fine to very fine textured deposits in the area, an Orthic Black or Dark Brown Chernozem will develop, with the depth to Ck greater than 30 cm. On the upper slopes and knolls soil profiles tend to be less well developed i.e. Calcareous Black, shallow Orthic Black or Rego Black. Deep cultivation may result in mixing of thin soil horizons on knolls resulting in Rego Black Chernozems where previously a Calcareous or shallow Orthic Black Chernozem existed. On coarse textured soils, shallow profiles are rare, even on the knolls.

Figure 4b shows a catenary sequence on a very gently to moderately undulating or hummocky topography. In depressional areas the soils may be saturated due to a combination of high water tables, low permeability and high upslope runoff. In these soils reducing conditions may exist for a period of time

which are responsible for the development of gleyed profiles. In these cases, Gleyed Black Chernozems or Orthic Humic Gleysols may form. Orthic Humic Gleysols are generally found in the lowest landscape positions where saturated conditions persist for most of the year. Under certain discharge conditions these Gleysols may be saline or sodic.

Eluviated Black Chernozems form on permeable deposits in lower slope positions that receive runoff. Part of the clay fraction in these soils has been eluviated from the A to B horizon. In less permeable deposits where there is no translocation of clay particles but water saturated soil conditions occur for short periods of time, Gleyed Black Chernozems develop. Orthic Black Chernozemic soils form if none of the above conditions exist. Eluviated Black Chernozems occurred very rarely in the study area.

Mid slope positions are typically occupied by well developed Orthic Black Chernozems. Towards the knoll the profiles are weakly developed and range from Calcareous Black Chernozems to Orthic Regosols. If the knolls are flat topped then Orthic Blacks usually form in that position. Wind or water erosion is responsible for some shallow profiles on the steeper slopes or knolls. Cultivation may mix A, B and upper C horizons on shallow soils resulting in Rego Black Chernozems. If these soils are further eroded the resulting classification would either be Rego Black, eroded phase or Orthic Regosol.

Solonetzic soils form when relatively high levels of sodium ions exist in the soil. Sodium causes the clay particles in the upper soil to disperse and leach downward into the B horizon. The result is a strongly structured, relatively

impermeable Bnt horizon. With time the B horizon weathers thereby weakening structure and improving permeability. Within the study area Solonetzic soils do not occur extensively, generally only in isolated depressional areas.

4.3 SOILS DEVELOPED ON LACUSTRINE AND LACUSTRO-TILL DEPOSITS

Fine to very fine lacustrine and lacustro-till deposits are the most common parent material within the study area. These deposits are generally nearly level to very gently undulating and reach depths of 45 m. Calcareous and Orthic Black Chernozems are the dominant soils developed on these deposits. Calcareous and Orhtic Dark Brown Chernozems occur in Twps 7-28 and 7-29. Parent materials are typically moderately to strongly calcareous, nonsaline and nonsodic.

The typical Orthic Black Chernozem on a lacustrine or lacustro-till deposit has the following characteristics.

Horizon	Depth (cm)	Description
Ap	0-21	Black (10 YR 2.5/1.5 m), clay, moderate medium granular, friable, plastic, pH 7.1, nonsaline, nonsodic
Bm	21-35	Dark yellowish brown (10 YR 3.0/6 m) clay, moderate medium subangular blocky, firm, plastic, pH 6.6, nonsaline, nonsodic
CK1	35-90	Dark yellowish brown (10 YR 4.5/6 m) clay to heavy clay, massive to medium pseudo blocky, very firm, very plastic, pH 7.9, nonsaline, nonsodic, lacustrine
CK2	90+	Olive brown (2.5 Y 4/4 m) heavy clay, massive, very firm, very plastic, pH 8.3, nonsaline, nonsodic, lacustrine

If not present to the soil surface, lacustro-till material containing less than 2% cobbles is occassionally encountered with 2 m.

The typical Calcareous Black Chernozem has similar characteristics to the above described profile except for:

(1) a shallower Ap horizon (i.e. 0-15)
(2) A Bmk horizon instead of a Bm horizon.

The Bmk horizon is closer in colour to the underlying Ck horizon and contains free carbonate.

4.4 SOILS DEVELOPED ON GLACIAL TILL

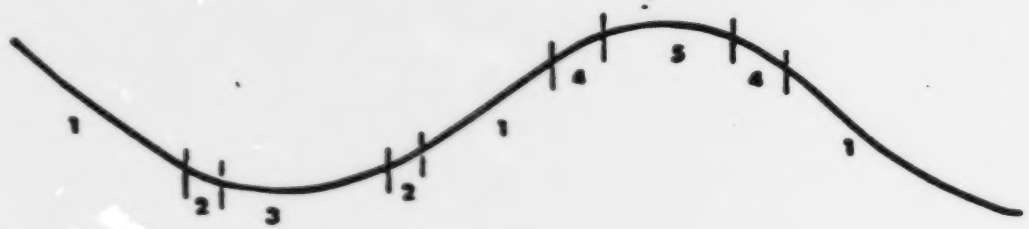
Glacial till deposits are primarily associated with bedrock controlled ridges, plateaus or hilly topography. Orthic and Calcareous Black Chernozems are the dominant soils developed on these deposits. The till in the area is moderately to strongly calcareous and typically nonsaline and nonsodic.

The typical Orthic Black Chernozem on a glacial till deposit has the following characteristics. (Note these soils are common to native pasture lands).

4a. Profiles on nearly level undulating topography.

SYMBOL	SLOPE POSITION	SOIL TYPE	DRAINAGE
1	depression to upper	O.BL, Cx > 30 cm	moderately to well
2	upper to knoll	CA.BL, D.BL or R.BL, Cx < 30 cm	well

4b. Profiles on very gently to moderately undulating or hummocky topography.



SYMBOL	SLOPE POSITION	SOIL TYPE	DRAINAGE
1	upper mid to lower	O.BL	well
2	lower	E.BL	moderately well to imperfect
3	depression	O.HG	poorly
4	upper	CA.BL	well
5	knoll	CA.BL-R.BL	well

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Figure 4. Diagramatic representation of profiles on nearly level and very gently to moderately undulating topography.

Horizon	Depth (cm)	Description
Ah	0-23	Black (10 YR 2.5/1.5 d), clay loam, moderate medium granular, friable, slightly plastic, pH 6.8
Bm	23-40	Strong brown (7.5 YR 4.5/6 m), clay to clay loam, moderate subangular blocky, friable, slightly plastic, pH 6.6
Ck	40-150	Dark yellowish brown (10 YR 4.5/6 m) clay, massive, firm, plastic, pH 7.8
R	150+	Sandstone

4.5 SOILS DEVELOPED ON GLACIO FLUVIAL DEPOSITS

Glaciofluvial soil parent materials are deposited by glacial meltwater; the energy of which determine the texture and coarse fragment content. Soils developed on medium textured, gravel free deposits have good irrigation potential. The dominant soil development on glaciofluvial deposits in the study area is Calcareous Dark Brown Chernozemic. A typical profile developed on a coarse fragment free deposit has the following characteristics.

Horizon	Depth (cm)	Description
Apk	0-15	Dark brown (10 YR 4/2 d), fine sandy loam, weak fine granular to single grain, very friable, nonplastic, pH 7.3
Bmk	15-28	Yellowish brown (10 YR 5/4 m) loamy fine sand, single grain, loose, nonplastic, pH 7.3
CK1	28-50	Yellowish brown (10 YR 5/4 m) fine sandy loam, massive, friable, nonplastic, pH 7.5
CK2, 3, 4, etc.	50+	Colour, pH and structure remain relatively constant. Stratigraphy is typically variable and soil texture ranges from fine sand to very fine sandy loam.

5.0 LAND IRRIGABILITY CLASSIFICATION

Within the East of Pincher Creek Block area, 11 land classes and subclasses were identified. Five of these are suitable for irrigation (26410 ha; 65,230 ac), three are nonirrigable pending more detailed investigation (2050 ha; 5060 ac), and three are nonirrigable (9140 ha; 22,580 ac). A further 30 ha (75 ac) of waterbodies, sloughs and other lands are also classified as nonirrigable. Table 5 lists the land classes and the limitations occurring within the Pincher Creek East area and Table 6 shows the area of irrigable classes for each township. Approximately 9.5% (3580 ha; 8840 ac) of the total area is suitable for gravity or sprinkler irrigation. A further 61% (22820 ha; 56,360 ac) is suitable for sprinkler irrigation only.

5.1 LAND CLASS $2\frac{ST}{22}$

This land class has moderate soil and topographic limitations that restrict irrigation land use. These areas occur on medium to moderately fine textured deposits, on very gently to gently (2-9% slopes) undulating topography. The soils are dominantly Calcareous Dark Brown and Orthic Black Chernozems that are moderately to slowly permeable, and well drained. Soil limitations are low moisture holding capacity and/or high lime content. There is a small portion of soils with shallow profile development.

The topographic limitation restricts these soils to sprinkler irrigation methods only. Water application should take into account the potential for ponding in depressions, and soil

TABLE 5

SOIL AND TOPOGRAPHIC LIMITATIONS IN PINCHER CREEK EAST AREA

	Irrigability Land Class and Subclass										
	2 ST/22	3 ST/31	3 ST/32	4 ST/23	4 ST/33	5 ST/41	5 ST/42	5 ST/43	6 T/4	6 ST/42	6 ST/43
	M* K	D S N E K	D E (1) K S N W U	G R	R G (1)	S N W D	S N M D E	R G E	RB G B	R N S E M	R G RB K
Area**											
(ha)	2520	3580	18880	70	1350	400	1100	550	5860	1730	1550
(ac)	6210	8850	46640	180	3340	980	2720	1350	14490	4280	3840

* Limitations
- M - low moisture holding capacity
- K - shallow profile development
- D - low permeability and/or undesirable structure
- S - salinity
- N - sodicity
- U - earthmoving
- E - erosion damage
- (1) - fine texture/high lime
- W - excessive wetness
- R - shallowness to bedrock
- G - steep slopes
- RB - rough broken topography
- B - tree or brush cover

** Water bodies and sloughs occupy a total of 34.8 ha (86 ac) (rounded). Inconsistencies between hectares and acres are due to rounding. All figures are rounded to nearest 10 units.

TABLE 6

AREA OF LAND IRRIGABILITY CLASSES
PINCHER CREEK EAST AREA
hectares (acres)

Tp-Rg	5-28	6-28	6-29	6-30	7-28	7-29	8-28	8-29	Total	
Land	Area	Area	Area	Area	Area	Area	Area	Area	Area	%
1 $\frac{ST}{11}$	0	0	0	0	0	0	0	0	0	
2 $\frac{ST}{12}$	0	0	0	0	0	0	0	0	0	
2 $\frac{ST}{21}$	0	0	0	0	0	0	0	0	0	
2 $\frac{ST}{22}$	0	320	120	50	520	760	650	100	2520	6.7
Subtotal	0 (0)	320 (800)	120 (280)	50 (130)	520 (1290)	760 (1870)	650 (1600)	100 (250)	2520 (6220)	6.7
3 $\frac{ST}{31}$	10	870	610	10	1350	700	40	0	3580	9.5
3 $\frac{ST}{32}$	1500	2530	5330	1620	390	3530	610	3360	18880	50.2
Subtotal	1510 (3730)	3400 (8410)	5940 (14680)	1630 (4030)	1740 (4300)	4230 (10460)	650 (1600)	3360 (8310)	22460 (55520)	60.0
4 $\frac{ST}{13}$	0	0	0	0	0	0	0	0	0	
4 $\frac{ST}{23}$	0	0	60	0	0	0	0	20	80	0.2
4 $\frac{ST}{33}$	0	50	200	40	0	70	90	900	1350	3.6
Subtotal	0 (0)	50 (110)	260 (640)	40 (100)	0 0	70 (180)	90 (230)	920 (2260)	1430 (3520)	3.8
5 $\frac{ST}{41}$	10	120	250	20	0	0	0	0	400	1.1
5 $\frac{ST}{42}$	0	340	50	170	90	220	10	220	1100	2.9
5 $\frac{ST}{43}$	0	0	0	0	0	360	0	190	550	1.4
Subtotal	10 (20)	460 (1130)	300 (750)	190 (480)	90 (210)	580 (1430)	10 (30)	410 (1000)	2050 (5050)	5.4
6 $\frac{T}{4}$	20	430	980	330	270	2230	620	980	5860	15.6
6 $\frac{ST}{41}$	0	0	0	0	0	0	0	0	0	
6 $\frac{ST}{42}$	0	< 5	140	0	440	1100	50	0	1730	4.6
6 $\frac{ST}{43}$	0	0	660	70	20	350	0	450	1550	4.1
Subtotal	20 (70)	430 (1060)	1780 (4410)	400 (980)	730 (1800)	3680 (9100)	670 (1660)	1430 (3540)	9140 (22610)	24.0
Sloughs and Waterbodies	10 (20)	< 5 (10)	< 5 (5)	20 (40)	< 5 (10)	< 5 (5)	0 (0)	0 (0)	30 (90)	0.1
TOTAL	1550 (3840)	4660 (11520)	8400 (20760)	2330 (5760)	3080 (7610)	9320 (23040)	2070 (5120)	6220 (15360)	37630 (93010)	100.0

Note: All values for area rounded to nearest 10 units (ha, ac). Inconsistencies between hectares and acres are due to rounding.

erosion. The possibility for perched water tables and lateral movement of salts also exists. The moderately fine soil textures also reduces the infiltration rate and therefore light frequent application of water may be necessary.

5.2 LAND CLASS $3\frac{ST}{31}$

This land class has moderately severe soil limitations that restrict the use of these areas for irrigation. These soils occur on fine to very fine lacustrine and lacustro-till deposits on level to nearly level topography. The soils are dominantly well developed Orthic and Calcareous Chernozems that are slowly permeable and moderately well drained. Soil limitations include low permeability, erosion damage and to a lesser degree, salinity, sodicity and shallow profile development.

These soils may be either gravity or sprinkler irrigated. Water application should be light to frequent to allow for the relatively low infiltration rates of these soils, and to prevent the development of a perched water table. Lateral movement of salts may occur on individual landscapes. Drainage may be required in wet depressional areas in order to realize maximum returns in some soil areas.

5.3 LAND CLASS $3\frac{ST}{32}$

This land class has moderately severe soil and moderate topographic limitations that restrict the use of these areas

for irrigation. These soils occur on fine to very fine lacustrine and lacustro-till materials. These material types are on very gentle to gently sloping (2-9%) undulating topography. Common soil limitations are listed in Table 5.

The soils are dominantly well to moderately well drained Calcareous and Orthic Black and Dark Brown Chernozems with significant amounts of shallow soils or poorly drained soils in depressions. The soils are typically slowly permeable. A significant portion of the soils have salinity levels that also limit the suitability for irrigation.

These soils are suitable only for sprinkler irrigation methods. The emphasis of water management in this land class should be to control salinity or sodicity problems downslope, and minimize soil erosion.

5.4 LAND CLASSES $4\frac{ST}{23}$ AND $4\frac{ST}{33}$

These classes have both soil and topographic limitations that restrict irrigation land use. The soils occur on moderately fine to fine textured glacial till deposits on moderate to strongly sloping (10-20% slopes) rolling and hummocky topography. The soils are dominantly well developed Orthic Black Chernozems with significant amounts of shallow soils that are slowly to moderately permeable, depending on depth to bedrock. The soils are moderately well to well drained, nonsaline and nonsodic.

Soil limitations in these areas are due to shallowness to bedrock, fine soil textures and/or high free carbonate content. The presence of steep slopes requires the use of specialized sprinkler systems designed to operate on rough ground and minimize runoff and water erosion. The potential exists for ponding of water in depressional areas on the finer textured soils if excessive amounts of water are applied. A permanent forage crop may be the best crop to grow on this land class under irrigation.

5.5 LAND CLASSES $5\frac{ST}{41}$, $\frac{ST}{42}$ AND $\frac{ST}{43}$

These classes are nonirrigable due to severe soil limitations. They may be upgraded to an irrigable class pending a more detailed investigation and/or implementation of improvement practices. Soils were placed in class 5 if more than 30% of the soils within the map unit have properties that exclude them from other irrigable classes mainly due to the following: excessive wetness, salinity, sodicity, or shallowness to bedrock. The provision of surface or subsoil drainage for wetlands, and flushing of salts may allow these soils to be classed as irrigable.

The extent of bedrock in some areas may need to be better defined by more drilling. A more intensive investigation may show that shallow bedrock is not a severe limitation, depending on its contour and topography. Areas of topography class 3, even after implementation of improvements, will require specialized sprinkler systems designed to operate on

rough ground and minimize runoff and water erosion. A permanent forage crop may be the best crop to grow on such soils if they are irrigated.

5.6 LAND CLASSES $6\frac{ST}{42}$ AND $6\frac{ST}{43}$

Soils in this land class are nonirrigable due to very severe limitations because of salinity, sodicity, gravel, shallowness to bedrock or excessive wetness.

5.7 LAND CLASS $6\frac{T}{4}$

These lands are nonirrigable due to steep slopes (greater than 20%), rough broken lands, excessive stones or brush cover.

6.0 EFFECTS OF IRRIGATION ON SOILS AND WATER MANAGEMENT REQUIREMENTS

Irrigation agriculture can be sustained on the majority of soils in the Pincher Creek East area. The potential exists for salinization on Class 4 lands with salinity or sodicity limitations if excessive amounts of water are applied. Light frequent applications of water is preferable to heavier applications on the soils of the study area in general.

Fine to very fine textured soils occur extensively throughout the area. These soils are developed either on lacustrine or lacustro-till deposits. In all cases the soils have relatively low infiltration rates. On sloping areas, there exists the potential for water erosion and ponding in depressional areas if excess water is applied.

On some of the soils adjacent ridge features, salinity exists within the root zone (soil limitation S). High water application rates may flush these salts downward and improve the upper soil quality. However, the potential exists for lateral movement of these salts downslope to discharge either into local depressions, such as sloughs, or into larger landscape lows such as the ice margin melt water channels.

The presence of shallow bedrock (R limitation) also provides an impermeable barrier which may channel water laterally carrying salts or create a subsurface water table at a shallow depth.

The coarse textured glacio fluvial soils overlie finer materials that are non-saline or non-sodic. These soils (land class 2) would require light, frequent applications of water. Losses of nutrients, particularly nitrogen would likely occur through leaching if excessive water is applied. Water applications should be such that adequate root zone moisture levels are maintained during the growing season. Excess water may perch above impermeable layers resulting in either a zone of waterlogged soil or lateral movement of water and soluble salts that may discharge downslope.

The coarse textured soils are also potentially erodible by wind. As a result the more intensive farming that goes along with irrigation development should include special conservation practices such as conservation of stubble, wind breaks or growing of perennial forage crops in rotation to minimize wind erosion losses.

7.0 RECOMMENDATIONS

The following recommendations are made on the basis of information gathered during this study:

(1) The land class should be one of the major criteria considered when priorizing land for irrigation development. Class 2 land should be given the highest priority, whereas Class 4 land should be given the lowest priority for irrigation development. Class 5 land is non-irrigable, but may have potential for irrigation, pending a more detailed investigation and/or reclamation. Class 6 land is non-irrigable with no potential for irrigation development.

(2) Townships 7-28, 7-29 and 8-28 account for 77% (1930 ha; 4770 ac) of the Class 2 land mapped in the study area. Township 7-29 contains the largest continuous area of Class 2 land. Townships 6-29 and 7-29 contain 44% (11,050 ha; 27,290 ac) of the total Class 2 and 3 land in the area and for this reason should be given the highest priority for irrigation development. The potential for expansion within Townships 6-28, 7-28 and 8-29 are good.

(3) Careful irrigation management is needed for the fine textured soils to prevent ponding or raising the water table. Light frequent water application may be required.

(4) Special sprinkler adaptation may be required to increase water use efficiencies in the high wind condition common to the area.

(5) All of the cultivated land within the study area has been affected by wind erosion. The extent of damage ranges from slight to severe. To reduce further topsoil losses and land degradation the use of natural and/or artificial wind breaks should be encouraged.

8.0 REFERENCES

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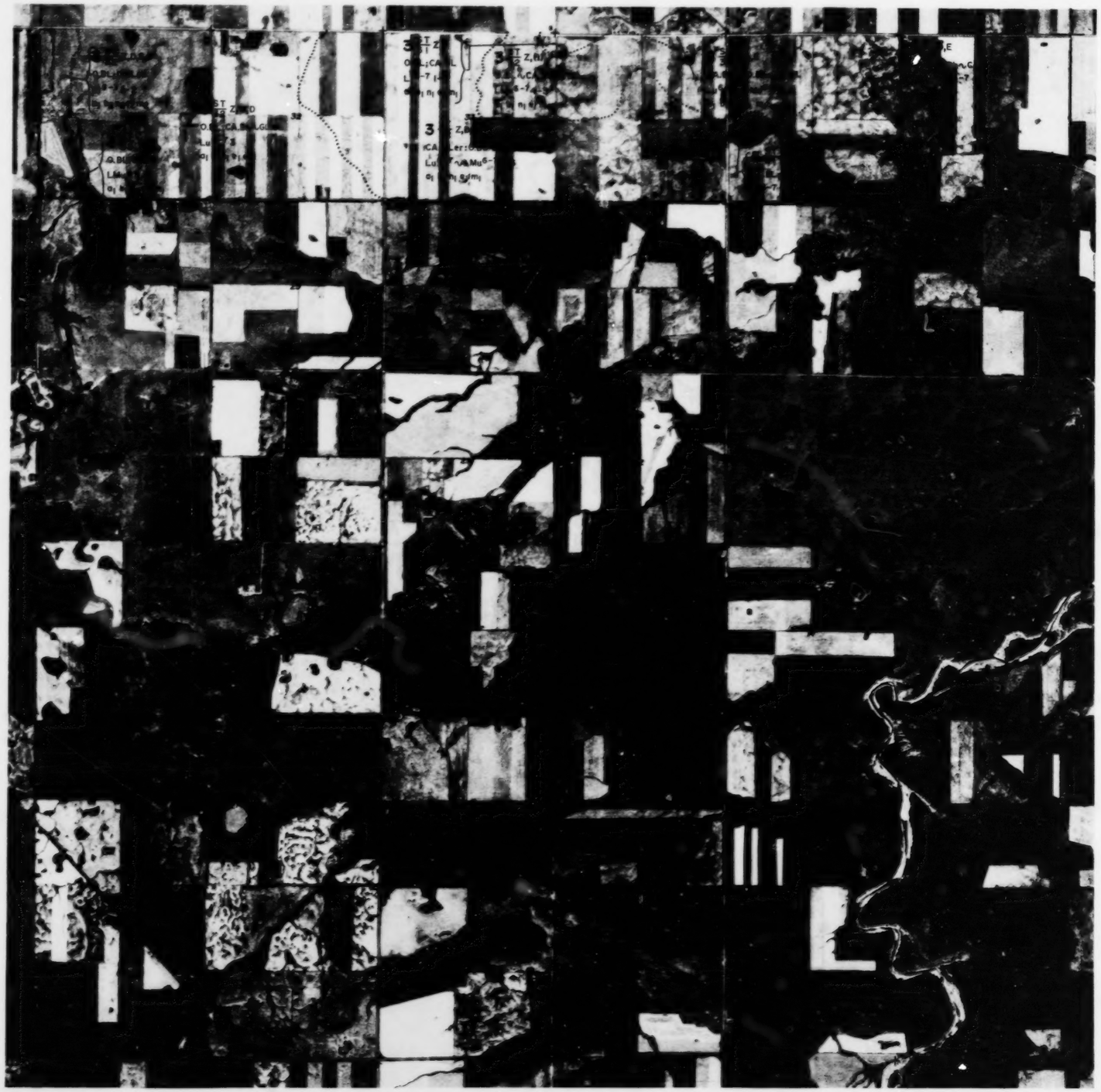
APPENDIX A

Irrigability Maps



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)		LAND CLASS	Acres (hectares)	
1	0	(0)	4	0	(0)
2	0	(0)	5	20	(10)
3	3730	(1510)	6	90	(30)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY: 3 S T / Y,S,M
- TOPOGRAPHY SYMBOL
- LIMITING FACTORS
- DRAINABILITY
- TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase: O.DB; O.DB, so
Soil Textural Class
Genetic Material: Lv / Mu 3 — Slope Class
Surface Expression
w_2 — Other Factors
$a_1 b_1 n_1 s_1 m_1 ; a_4 b_3 n_3$ — Soil Chemistry

LAND CLASSES

1: Excellent capability with no significant limitations for irrigation.
2: Good capability with moderate limitations for irrigation.
3: Fair capability with moderately severe limitations for irrigation.
4: Restricted capability requiring a special system design and/or special management.
5: Non-irrigable pending detailed investigation, implementation of an improvement and/or undergoing reclamation. Land within this class may be upgraded to an irrigable class or will be rated Class 6.
6: Non-irrigable.

SOIL CATEGORIES
1.. Irrigable-Excellent
2.. Irrigable-Good
3.. Irrigable-Fair
4.. Non-Irrigable

TOPOGRAPHY CATEGORIES
1.. Irrigable-Gravity
2.. Irrigable-Sprinkler
3.. Irrigable-Special System Design
4.. Non-Irrigable

DRAINABILITY
X.. Moderately to rapidly permeable
Y.. Slowly permeable
Z.. Relatively impermeable

SOIL LIMITATIONS
D.. low permeability/undesirable structure
R.. shallowness to bedrock
K.. shallow profile development
N.. sodicity
W.. excessive wetness
S.. salinity
M.. low moisture holding capacity
E.. erosion damage
(1).. high lime/very fine texture

TOPOGRAPHY LIMITATIONS
F.... surface drainage
G.... steep slopes
J.... field size, shape
B.... brush/tree cover
RB... rough broken
U.... earth moving
P.... stoniness

SOIL TAXONOMY
B.. Brown
DB.. Dark Brown
DG.. Dark Grey
BL.. Black
G.. Gleysol
HG.. Humic Gleysol
R.. Regosol
HR.. Humic Regosol
SZ.. Solonetz
SS.. Solodized Solonetz
SO.. Solod
O.. Orthic
R.. Rego
CA.. Calcareous
E.. Eluviated
SZ.. Solonetzic
GL.. Gleyed
CU.. Cumulic
A.. Alkaline

SOIL PHASES
alk.. alkaline
calc.. calcareous
carb.. carbonated
er.... eroded
gr.... gravelly
li.... lithic
so.... saline
st.... stony

GENETIC MATERIAL
A.... Anthropogenic
C.... Colluvial
E.... Eolian
F.... Fluvial
L.... Lacustrine
M.... Morainal (Till)
R.... Bedrock
S.... Saprolite (Residual)
U.... Undifferentiated

SURFACE EXPRESSION
a.. apron
b.. blanketed
f.. fan
h.. hummocky
i.. inclined
l.. level
m.. rolling
r.. ridged
s.. steep
t.. terraced
u.. undulating
v.. veneered

TEXTURE
0.. Gravel
1.. Sand
2.. Loamy Sand
3.. Sandy Loam, Fine Sandy Loam
4.. Loam, Silt Loam, Very Fine Sandy Loam
5.. Silty Clay Loam, Clay Loam Sandy Clay Loam
6.. Silty Clay, Clay, Sandy Clay
7.. Heavy Clay

SLOPE CLASS / PERCENT SLOPE / TERMINOLOGY

SLOPE CLASS	PERCENT SLOPE	TERMINOLOGY
1	0 - 0.5	Level
2	0.5 - 2	Nearly Level
3	2 - 5	Very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY		DEPTH (m)
R_1	S_1	>3
R_2	S_2	2 - 3
R_3	S_3	1 - 2
R_4	S_4	<1

SALINITY AND SODIGITY
a.. salinity between 0 to 0.5m
b.. salinity between 0.5 to 1 m
n.. sodicity between 0 to 1 m
s.. salinity between 1 to 2 m
m.. sodicity between 1 to 2 m

ABUNDANCE DESIGNATIONS
~ - nearly equal occurrence
: - significant occurrence
– - range
; - minor occurrence

MAP SYMBOLS
..... - land class boundary
— — — - field boundary
—·—·— - investigation boundary
- slough or wetland
D.L. - disturbed land
- open water
- coulee or low area
- drain
+33 - section corner and number

NOTE: FOR PLANNING PURPOSES ONLY, NOT FOR OBTAINING WATER RIGHTS.

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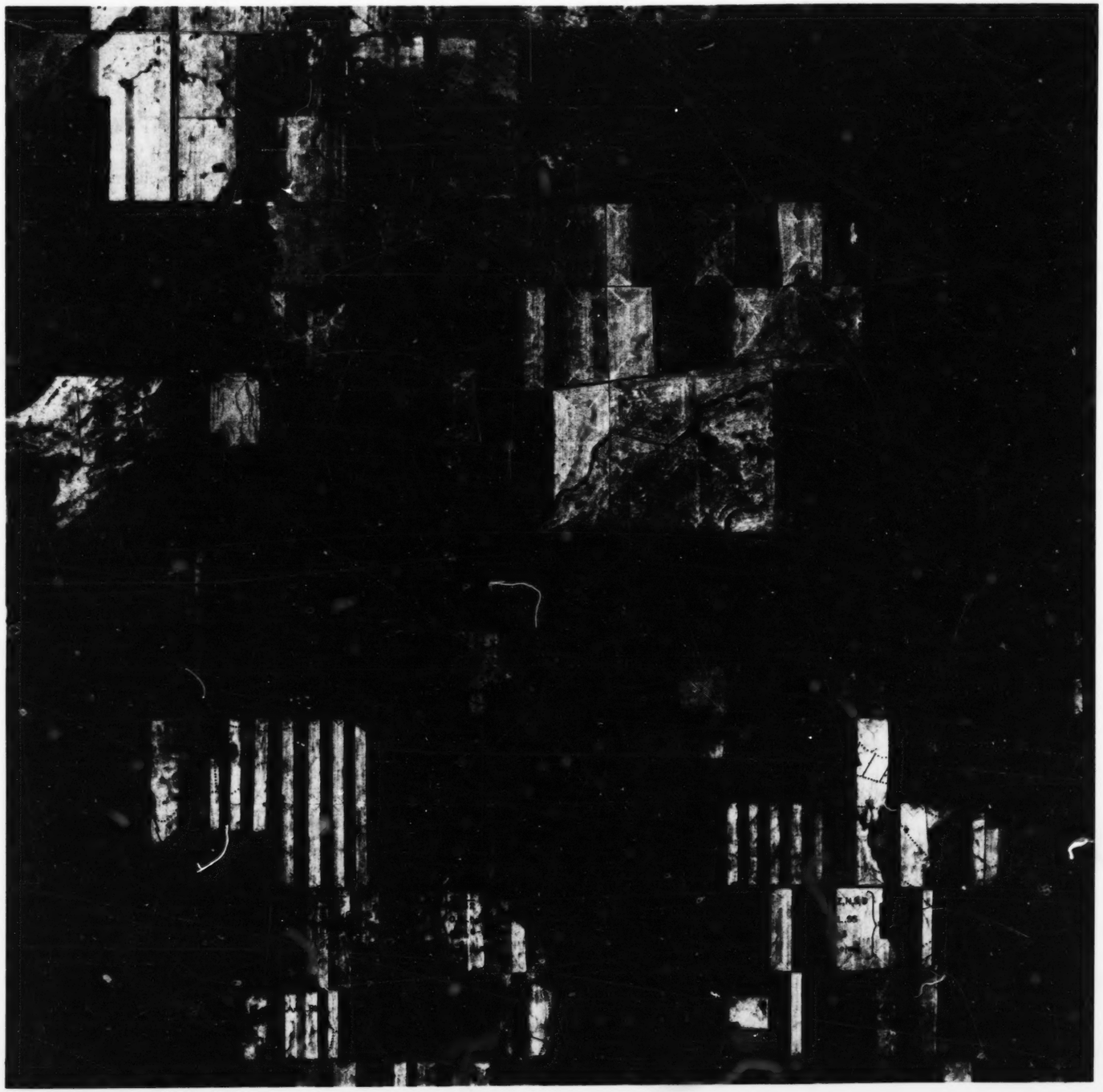
Alberta AGRICULTURE
RESOURCE PLANNING DIVISION

IRRIGABLE LAND INVENTORY IN SOUTHERN ALBERTA

LAND IRRIGABILITY CLASSIFICATION LEVEL III
PINCHER CREEK EAST AREA

T5. R28 W4M

SCALE 1 40 000
DATE 1986-03-31
SUBMITTED C. G. Heath
DATE Feb 28, 1986
APPROVED Lino G. Markanis
DATE Feb. 26, 1986
DESIGNED ALBERTA AGRICULTURE
DRAWN A.H., D.F
DWG. No. X-200-H2-59
SHEET 1 OF 8
FILE No. 8870



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)	LAND CLASS	Acres (hectares)
1	0 (0)	4	110 (50)
2	800 (320)	5	1130 (460)
3	8410 (3400)	6	1070 (430)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY — TOPOGRAPHY SYMBOL — LIMITING FACTORS — DRAINABILITY — TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase — Soil Textural Class — Genetic Material — Surface Expression — Slope Class — Other Factors — Soil Chemistry

LAND CLASSES

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Y. Slowly permeable
Z. Relatively impermeable

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SO. Solod
O. Orthic
R. Rego
CA. Calcareous
E. Eluviated
SZ. Solonetzic
GL. Gleyed
CU. Cumulic
A. Alkaline

SOIL PHASES

alk. alkaline
calc. calcareous
carb. carbonated
er. eroded
gr. gravelly
li. lithic
sa. saline
st. stony

GENETIC MATERIAL

A. Anthropogenic
C. Colluvial
E. Eolian
F. Fluvial
L. Lacustrine
M. Morainal (Till)
R. Bedrock
S. Saprolite (Residual)
U. Undifferentiated

SURFACE EXPRESSION

a apron
b blanketed
f fan
h hummocky
i inclined
l level
m rolling
r ridged
s steep
t terraced
u undulating
v veneered

TEXTURE

0 Gravel
1 Sand
2 Loamy Sand
3 Sandy Loam, Fine Sandy Loam
4 Loam, Silt Loam, Very Fine Sandy Loam
5 Silty Clay Loam, Clay Loam Sandy Clay Loam
6 Silty Clay, Clay, Sandy Clay
7 Heavy Clay

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3	2 - 5	Very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
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W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY		DEPTH (m)
R_1	S_1	>3
R_2	S_2	2 - 3
R_3	S_3	1 - 2
R_4	S_4	<1

SALINITY AND SODICITY

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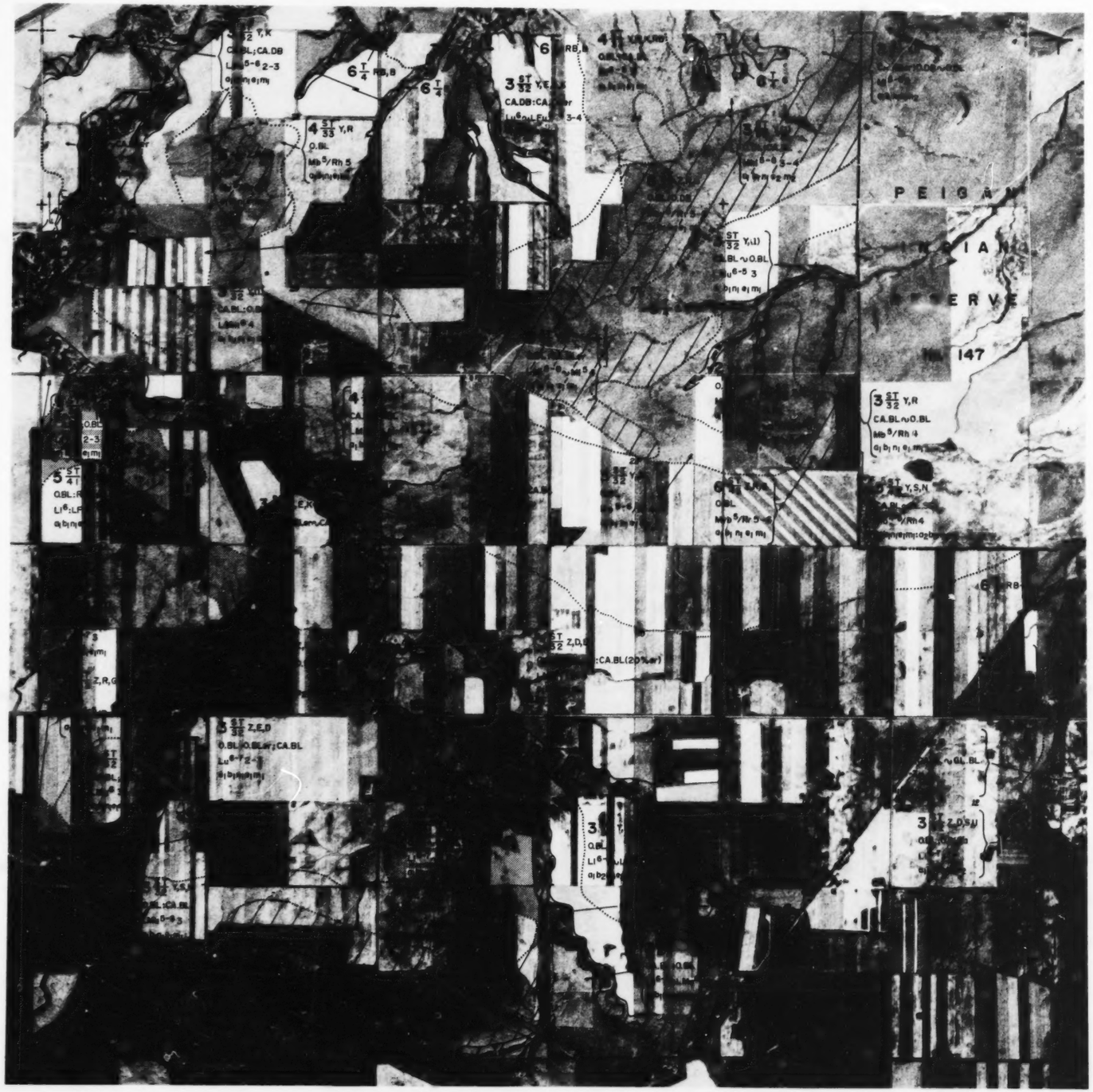
Alberta AGRICULTURE
RESOURCE PLANNING DIVISION

IRRIGABLE LAND INVENTORY IN SOUTHERN ALBERTA

LAND IRRIGABILITY CLASSIFICATION LEVEL III
PINCHER CREEK EAST AREA

T6 R28 W4M

SCALE 1:40 000	DATE 1986-03-31
SUBMITTED C.G. Heath	DESIGNED ALBERTA AGRICULTURE
DATE Feb. 26, 1986	DRAWN A.H., D.F.
APPROVED Dave G. Karkanis	DWG. No. X-200-H2-59
DATE Feb. 26, 1986	SHEET 2 OF 8 — FILE No. 8871



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)	LAND CLASS	Acres (hectares)
1	0 (0)	4	640 (260)
2	280 (120)	5	750 (300)
3	14680 (5940)	6	4410 (1780)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY — TOPOGRAPHY SYMBOL — LIMITING FACTORS — DRAINABILITY — TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase; Soil Textural Class; Genetic Material; Surface Expression — Slope Class; Other Factors; Soil Chemistry

LAND CLASSES

1. Excellent capability with no significant limitations for irrigation.
2. Good capability with moderate limitations for irrigation.
3. Fair capability with moderately severe limitations for irrigation.
4. Restricted capability requiring a special system design and/or special management.
5. Non-irrigable pending detailed investigation, implementation of an improvement and/or undergoing reclamation. Land within this class may be upgraded to an irrigable class or will be rated Class 6.
6. Non-irrigable

SOIL CATEGORIES

1. Irrigable-Excellent
2. Irrigable-Good
3. Irrigable-Fair
4. Non-Irrigable

TOPOGRAPHY CATEGORIES

1. Irrigable-Gravity
2. Irrigable-Sprinkler
3. Irrigable-Special System Design
4. Non-Irrigable

DRAINABILITY

X Moderately to rapidly permeable
Y Slowly permeable
Z Relatively impermeable

SOIL LIMITATIONS

D low permeability/undesirable structure
R shallowness to bedrock
K shallow profile development
N sodicity
W excessive wetness
S salinity
M low moisture holding capacity
E erosion damage
(1) high lime/very fine texture

TOPOGRAPHY LIMITATIONS

F surface drainage
G steep slopes
J field size, shape
B brush/tree cover
RB rough broken
U earth moving
P stoniness

SOIL TAXONOMY

B Brown
DB Dark Brown
DG Dark Grey
BL Black
G Gleysol
HG Humic Gleysol
R Regosol
HR Humic Regosol
SZ Solonetz
SS Solodized Solonetz
SO Solod
O Orthic
R Rego
CA Calcareous
E Eluviated
SZ Solonetzic
GL Gleyed
CU Cumulic
A Alkaline

SOIL PHASES

alk alkaline
calc calcareous
carb carbonated
er eroded
gr gravelly
li lithic
sa saline
st stony

GENETIC MATERIAL

A Anthropogenic
C Colluvial
E Eolian
F Fluvial
L Lacustrine
M Morainal (Till)
R Bedrock
S Saprolite (Residual)
U Undifferentiated

SURFACE EXPRESSION

a apron
b blanketed
f fan
h hummocky
i inclined
l level
m rolling
r ridged
s steep
t terraced
u undulating
v veneered

TEXTURE

0 Gravel
1 Sand
2 Loamy Sand
3 Sandy Loam, Fine Sandy Loam
4 Loam, Silt Loam, very Fine Sandy Loam
5 Silty Clay Loam, Clay Loam Sandy Clay Loam
6 Silty Clay, Clay, Sandy Clay
7 Heavy Clay

SLOPE CLASS	PERCENT SLOPE	TERMINOLOGY
1	0 - 0.5	Level
2	0.5 - 2	Nearly Level
3	2 - 5	very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY		DEPTH (m)
R_1	S_1	>3
R_2	S_2	2 - 3
R_3	S_3	1 - 2
R_4	S_4	<1

SALINITY AND SODICITY

a salinity between 0 to 0.5m
b salinity between 0.5 to 1 m
n sodicity between 0 to 1 m
e salinity between 1 to 2 m
m sodicity between 1 to 2 m

ABUNDANCE DESIGNATIONS

~ - nearly equal occurrence
- - significant occurrence
- - range
, - minor occurrence

MAP SYMBOLS

- land class boundary
- field boundary
- investigation boundary
- slough or wetland
- disturbed land
- open water
- coulee or low area
- drain
- +33 section corner and number

NOTE FOR PLANNING PURPOSES ONLY, NOT FOR OBTAINING WATER RIGHTS.

Prepared by HARDY ASSOCIATES (1978) LTD

Alberta AGRICULTURE
RESOURCE PLANNING DIVISION

IRRIGABLE LAND INVENTORY IN SOUTHERN ALBERTA

LAND IRRIGABILITY CLASSIFICATION LEVEL III
PINCHER CREEK EAST AREA

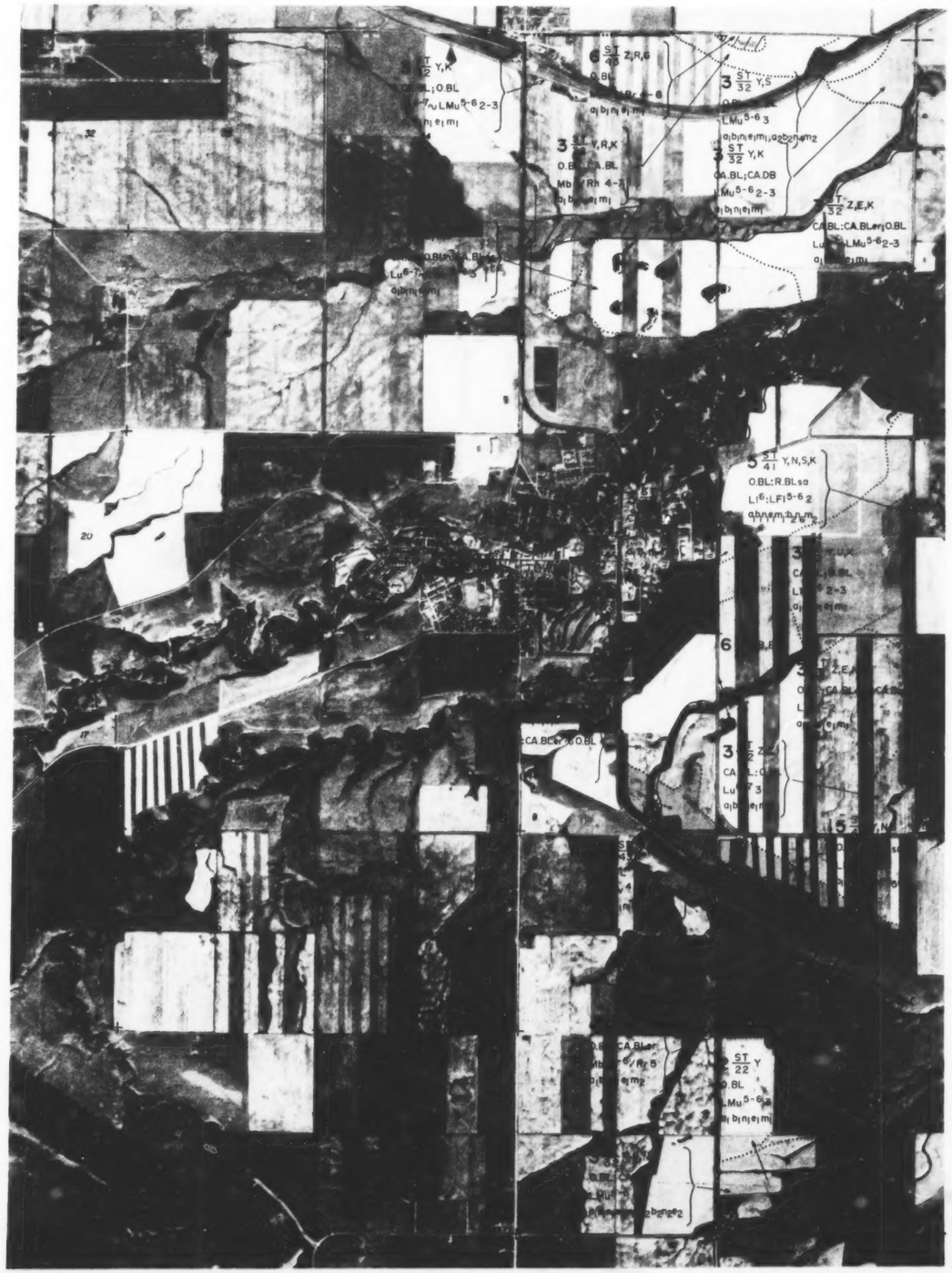
T6 R29 W4M

SCALE 1:40 000 — DATE 1986-03-31

SUBMITTED C.G. Head
DATE Feb 26, 1986
APPROVED Ronald Kirkham
DATE Feb. 26, 1986

DESIGNED ALBERTA AGRICULTURE
DRAWN A.H., D.F.

DWG. No. X-200-H2-59
SHEET 3 OF 8 — FILE No. 8872



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)		LAND CLASS	Acres (hectares)	
1	0	(0)	4	100	(40)
2	130	(50)	5	480	(190)
3	4030	(1630)	6	1020	(420)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY — TOPOGRAPHY SYMBOL — LIMITING FACTORS — DRAINABILITY — TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase — Soil Textural Class — Genetic Material — Surface Expression — Slope Class — Other Factors — Soil Chemistry

LAND CLASSES

1: Excellent capability with no significant limitations for irrigation.
2: Good capability with moderate limitations for irrigation.
3: Fair capability with moderately severe limitations for irrigation.
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6: Non-irrigable.

SOIL CATEGORIES

1. Irrigable-Excellent
2. Irrigable-Good
3. Irrigable-Fair
4. Non-Irrigable

TOPOGRAPHY CATEGORIES

1. Irrigable-Gravity
2. Irrigable-Sprinkler
3. Irrigable-Special System Design
4. Non-Irrigable

DRAINABILITY

X Moderately to rapidly permeable
Y Slowly permeable
Z Relatively impermeable

SOIL LIMITATIONS

D... low permeability/undesirable structure
R... shallowness to bedrock
K... shallow profile development
N... sodicity
W... excessive wetness
S... salinity
M... low moisture holding capacity
E... erosion damage
(1)... high lime/very fine texture

TOPOGRAPHY LIMITATIONS

F... surface drainage
G... steep slopes
J... field size, shape
B... brush/tree cover
RB... rough broken
U... earth moving
P... stoniness

SOIL TAXONOMY

B... Brown
DB.. Dark Brown
DG.. Dark Grey
BL.. Black
G... Gleysol
HG.. Humic Gleysol
R... Regosol
HR.. Humic Regosol
SZ.. Solonetz
SS.. Solodized Solonetz
SO.. Solod
O... Orthic
R... Rego
CA.. Calcareous
E... Eluviated
SZ.. Solonetzic
GL.. Gleyed
CU.. Cumulic
A... Alkaline

SOIL PHASES

alk... alkaline
calc.. calcareous
carb.. carbonated
er.... eroded
gr.... gravelly
li.... lithic
sa.... saline
st.... stony

GENETIC MATERIAL

A... Anthropogenic
C... Colluvial
E... Eolian
F... Fluvial
L... Lacustrine
M... Morainal (Till)
R... Bedrock
S... Saprolite (Residual)
U... Undifferentiated

SURFACE EXPRESSION

a... apron
b... blanketed
f... fan
h... hummocky
i... inclined
l... level
m... rolling
r... ridged
s... steep
t... terraced
u... undulating
v... veneered

TEXTURE

O. Gravel
1. Sand
2 Loamy Sand
3. Sandy Loam, Fine Sandy Loam
4. Loam, Silt Loam, Very Fine Sandy Loam
5. Silty Clay Loam, Clay Loam Sandy Clay Loam
6. Silty Clay, Clay, Sandy Clay
7. Heavy Clay

SLOPE CLASS	PERCENT SLOPE	TERMINOLOGY
.	0 - 0.5	Level
2	0.5 - 2	Nearly Level
3	2 - 5	Very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY		DEPTH (m)
R_1	S_1	>3
R_2	S_2	2 - 3
R_3	S_3	1 - 2
R_4	S_4	<1

SALINITY AND SODICITY

a. salinity between 0 to 0.5m
b. salinity between 0.5 to 1 m
n. sodicity between 0 to 1 m
e. salinity between 1 to 2 m
m... sodicity between 1 to 2 m

ABUNDANCE DESIGNATIONS

~ - nearly equal occurrence
- - significant occurrence
– – range
, - minor occurrence

MAP SYMBOLS

..... - land class boundary
– – – - field boundary
—·—·— - investigation boundary
- slough or wetland
D.L - disturbed land
- open water
- coulee or low area
- drain
+33 - section corner and number

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Prepared by HARDY ASSOCIATES (1978) LTD.

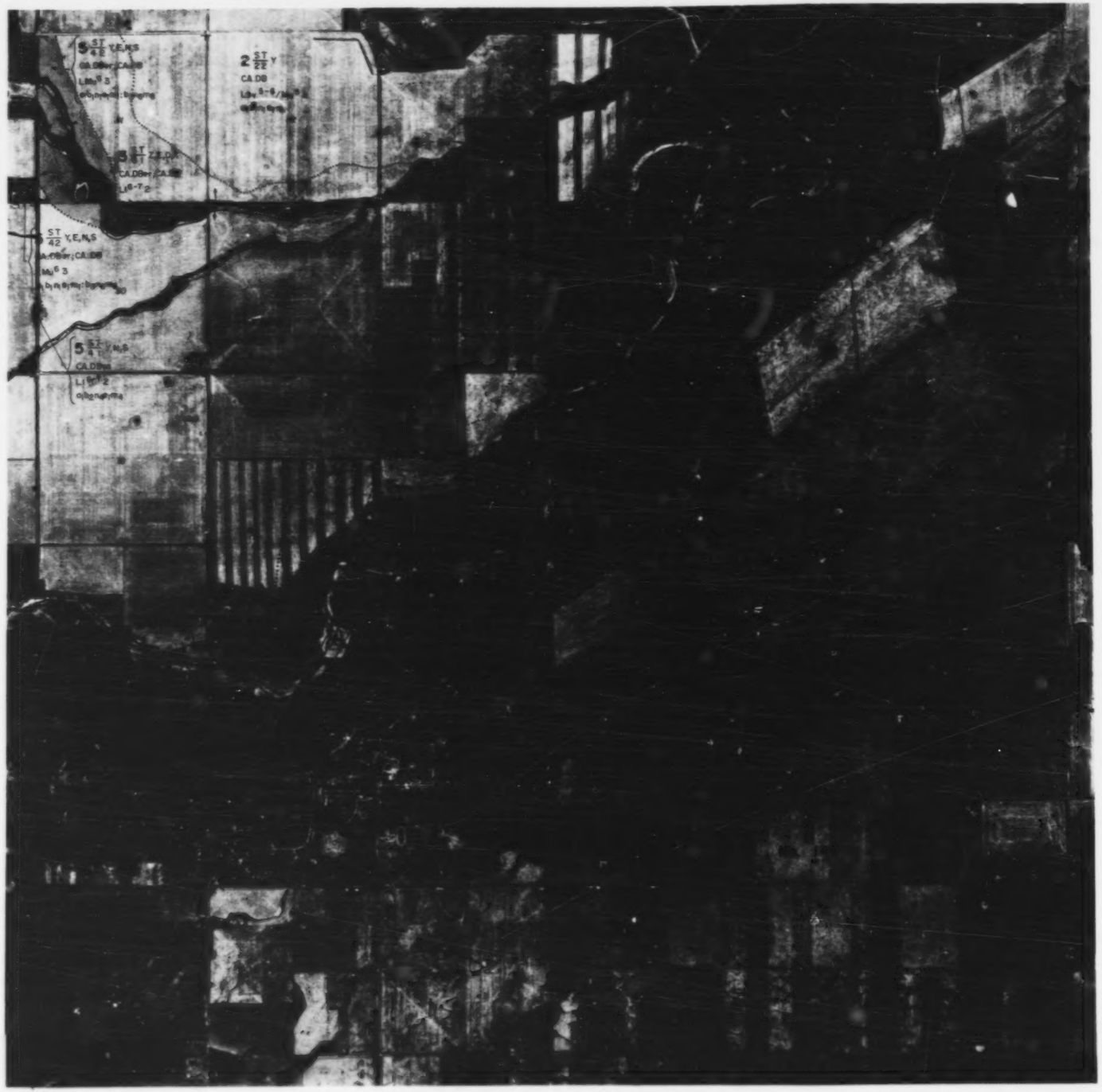
Alberta AGRICULTURE
RESOURCE PLANNING DIVISION

IRRIGABLE LAND INVENTORY IN SOUTHERN ALBERTA

LAND IRRIGABILITY CLASSIFICATION LEVEL III
PINCHER CREEK EAST AREA

TS. R30 W4M

SCALE 1:20000	DATE 1986-03-31
SUBMITTED C. G. Heath	DESIGNED ALBERTA AGRICULTURE
DATE Feb 24, 1986	DRAWN
APPROVED Dana G. Kirkham	DWG. No. X-200-H2-59
DATE Feb. 26, 1986	SHEET 4 OF 8 — FILE No. 8873



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)		LAND CLASS	Acres (hectares)	
1	0	(0)	4	0	(0)
2	1290	(520)	5	210	(90)
3	4300	(1740)	6	1810	(730)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY; TOPOGRAPHY SYMBOL; LIMITING FACTORS; DRAINABILITY; TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase; Soil Textural Class; Genetic Material; Surface Expression — Slope Class; Other Factors; Soil Chemistry

LAND CLASSES

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3 - Irrigable-Fair
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DRAINABILITY

X - Moderately to rapidly permeable
Y - Slowly permeable
Z - Relatively impermeable

SOIL LIMITATIONS

D - low permeability/undesirable structure
R - shallowness to bedrock
K - shallow profile development
N - sodicity
W - excessive wetness
S - salinity
M - low moisture holding capacity
E - erosion damage
(1) - high lime/very fine texture

TOPOGRAPHY LIMITATIONS

F - surface drainage
G - steep slopes
J - field size, shape
B - brush/tree cover
RB - rough broken
U - earth moving
P - stoniness

SOIL TAXONOMY

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DB - Dark Brown
DG - Dark Grey
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SS - Solodized Solonetz
SO - Solod
O - Orthic
R - Rego
CA - Calcareous
E - Eluviated
SZ - Solonetzic
GL - Gleyed
CU - Cumulic
A - Alkaline

SOIL PHASES

alk - alkaline
calc - calcareous
carb - carbonated
er - eroded
gr - gravelly
li - lithic
sa - saline
st - stony

GENETIC MATERIAL

A - Anthropogenic
C - Colluvial
E - Eolian
F - Fluvial
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a - apron
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TEXTURE

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6 - Silty Clay, Clay, Sandy Clay
7 - Heavy Clay

SLOPE CLASS / PERCENT SLOPE / TERMINOLOGY

SLOPE CLASS	PERCENT SLOPE	TERMINOLOGY
1	0 - 0.5	Level
2	0.5 - 2	Nearly Level
3	2 - 5	Very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY	DEPTH (m)
R_1 S_1	>3
R_2 S_2	2 - 3
R_3 S_3	1 - 2
R_4 S_4	<1

SALINITY AND SODICITY

a - salinity between 0 to 0.5m
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, - significant occurrence
- - range
; - minor occurrence

MAP SYMBOLS

- land class boundary
- field boundary
- investigation boundary
- slough or wetland
- D.L. - disturbed land
- open water
- coulee or low area
- drain
- +33 - section corner and number

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Prepared by
HARDY ASSOCIATES (1978) LTD

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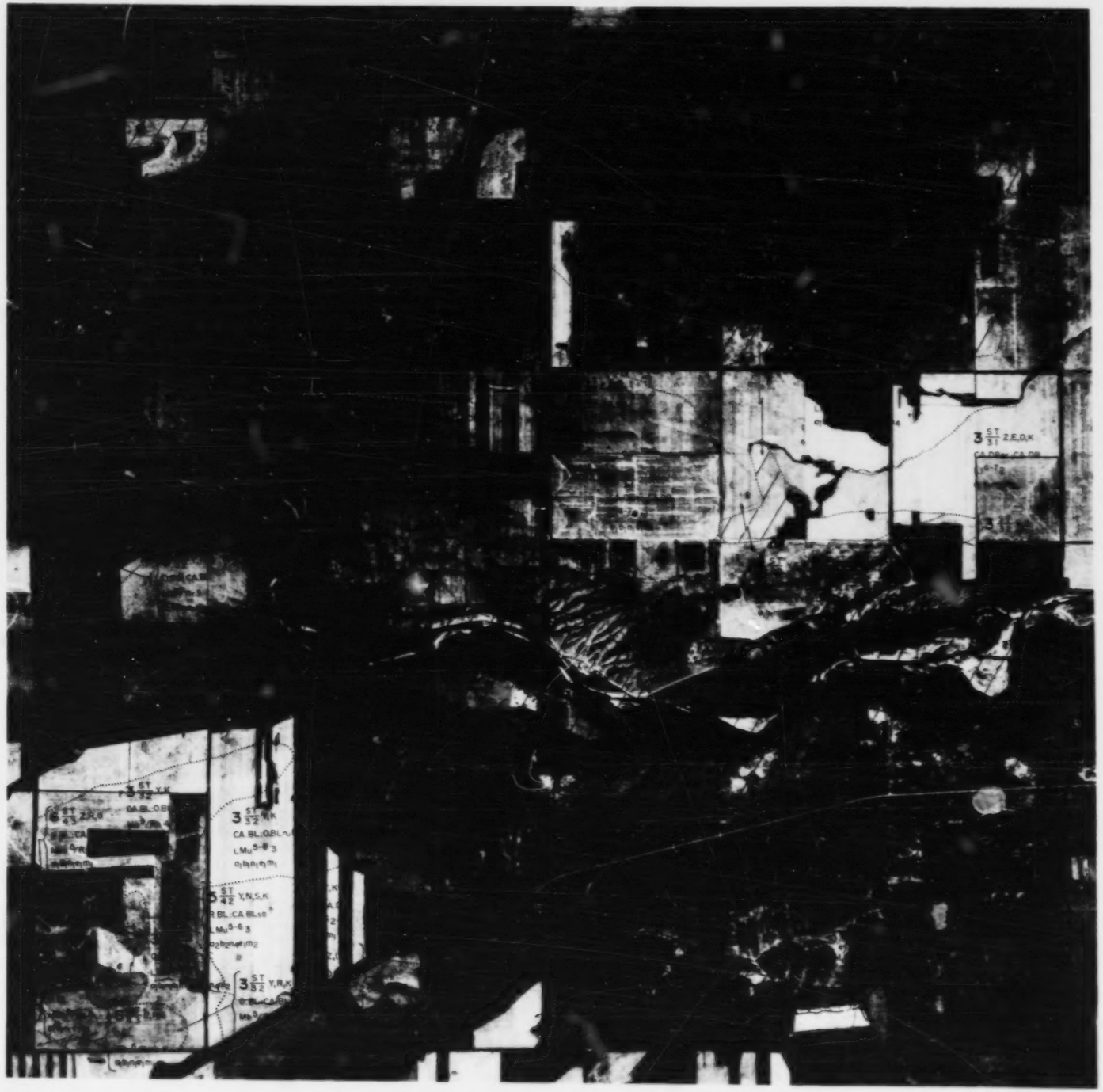
IRRIGABLE LAND INVENTORY IN SOUTHERN ALBERTA

LAND IRRIGABILITY CLASSIFICATION LEVEL III
PINCHER CREEK EAST AREA

T7 R29 W4M

SCALE 1:40 000	DATE 1986-03-31
SUBMITTED L. G. Heath	DESIGNED ALBERTA AGRICULTURE
DATE Feb 20, 1986	DRAWN A.H., D.F.
APPROVED Dave G. Kaukinis	DWG. No. X-200-H2-59
DATE July 26, 1986	SHEET 5 OF 8 — FILE No. 8874



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)	LAND CLASS	Acres (hectares)
1	0 (0)	4	180 (70)
2	1970 (760)	5	1430 (580)
3	10460 (4230)	6	9100 (3680)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY — TOPOGRAPHY SYMBOL — LIMITING FACTORS — DRAINABILITY — TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase
Soil Textural Class
Genetic Material — Slope Class
Surface Expression — Other Factors
Soil Chemistry

LAND CLASSES

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1. Irrigable - Gravity
2. Irrigable - Sprinkler
3. Irrigable - Special System Design
4. Non-Irrigable

DRAINABILITY

- X Moderately to rapidly permeable
- Y Slowly permeable
- Z Relatively impermeable

SOIL LIMITATIONS

- D low permeability/undesirable structure
- R shallowness to bedrock
- K shallow profile development
- N sodicity
- W excessive wetness
- S salinity
- M low moisture holding capacity
- E erosion damage
- (1) high lime/very fine texture

TOPOGRAPHY LIMITATIONS

- F surface drainage
- G steep slopes
- J field size, shape
- B brush/tree cover
- RB rough broken
- U earth moving
- P stoniness

SOIL TAXONOMY

- B Brown
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- a apron
- b blanketed
- f fan
- h hummocky
- i inclined
- l level
- m rolling
- r ridged
- s steep
- t terraced
- u undulating
- v veneered

TEXTURE

- 0 Gravel
- 1 Sand
- 2 Loamy Sand
- 3 Sandy Loam, Fine Sandy Loam
- 4 Loam, Silt Loam, Very Fine Sandy Loam
- 5 Silty Clay Loam, Clay Loam Sandy Clay Loam
- 6 Silty Clay, Clay, Sandy Clay
- 7 Heavy Clay

SLOPE CLASS	PERCENT SLOPE	TERMINOLOGY
	0 - 0.5	Level
	0.5 - 2	Nearly Level
2	2 - 5	Very gentle slope
3	6 - 9	Gentle slope
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6		

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY	DEPTH (m)
R_1 S_1	>3
R_2 S_2	2 - 3
R_3 S_3	1 - 2
R_4 S_4	<1

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DATE	DRAWN A.H., D.F.
APPROVED Dennis G. Kaskans	DWG. No. X-200-H2-59
DATE Feb 26, 1986	SHEET 6 OF 8 — FILE No. 0875

STATISTICAL SUMMARY

LAND CLASS	Acres	(hectares)	LAND CLASS	Acres	(hectares)
1	0	(0)	4	230	(90)
2	1600	(650)	5	30	(10)
3	1600	(650)	6	1660	(670)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY — TOPOGRAPHY SYMBOL — LIMITING FACTORS — DRAINABILITY — TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Phase — Soil Textural Class — Genetic Material — Surface Expression — Slope Class — Other Factors — Soil Chemistry

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GENETIC MATERIAL

A Anthropogenic
C Colluvial
E Eolian
F Fluvial
L Lacustrine
M Morainal (Till)
R Bedrock
S Saprolite (Residual)
U Undifferentiated

SURFACE EXPRESSION

a apron
b blanketed
f fan
h hummocky
i inclined
l level
m rolling
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u undulating
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TEXTURE

O Gravel
1 Sand
2 Loamy Sand
3 Sandy Loam, Fine Sandy Loam
4 Loam, Silt Loam, Very Fine Sandy Loam
5 Silty Clay Loam, Clay Loam Sandy Clay Loam
6 Silty Clay, Clay, Sandy Clay
7 Heavy Clay

SLOPE CLASS / PERCENT SLOPE / TERMINOLOGY

Class	Percent Slope	Terminology
.	0 - 0.5	Level
2	0.5 - 2	Nearly Level
3	2 - 5	Very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK(R) OR SAPROLITE (S)

CATEGORY		DEPTH (m)
R_1	S_1	>3
R_2	S_2	2 - 3
R_3	S_3	1 - 2
R_4	S_4	<1

SALINITY AND SODICITY

a salinity between 0 to 0.5m
b salinity between 0.5 to 1 m
n sodicity between 0 to 1 m
e salinity between 1 to 2 m
m sodicity between 1 to 2 m

ABUNDANCE DESIGNATIONS

~ - nearly equal occurrence
- significant occurrence
– - range
, - minor occurrence

MAP SYMBOLS

- land class boundary
- field boundary
- investigation boundary
- slough or wetland
- disturbed land
- open water
- coulee or low area
- drain
+33 - section corner and number

NOTE: FOR PLANNING PURPOSES ONLY, NOT FOR OBTAINING WATER RIGHTS.

Prepared by HARDY ASSOCIATES (1978) LTD.

Alberta AGRICULTURE
RESOURCE PLANNING DIVISION

IRRIGABLE LAND INVENTORY IN SOUTHERN ALBERTA

LAND IRRIGABILITY CLASSIFICATION LEVEL III
PINCHER CREEK EAST AREA

T8 R28 W4M

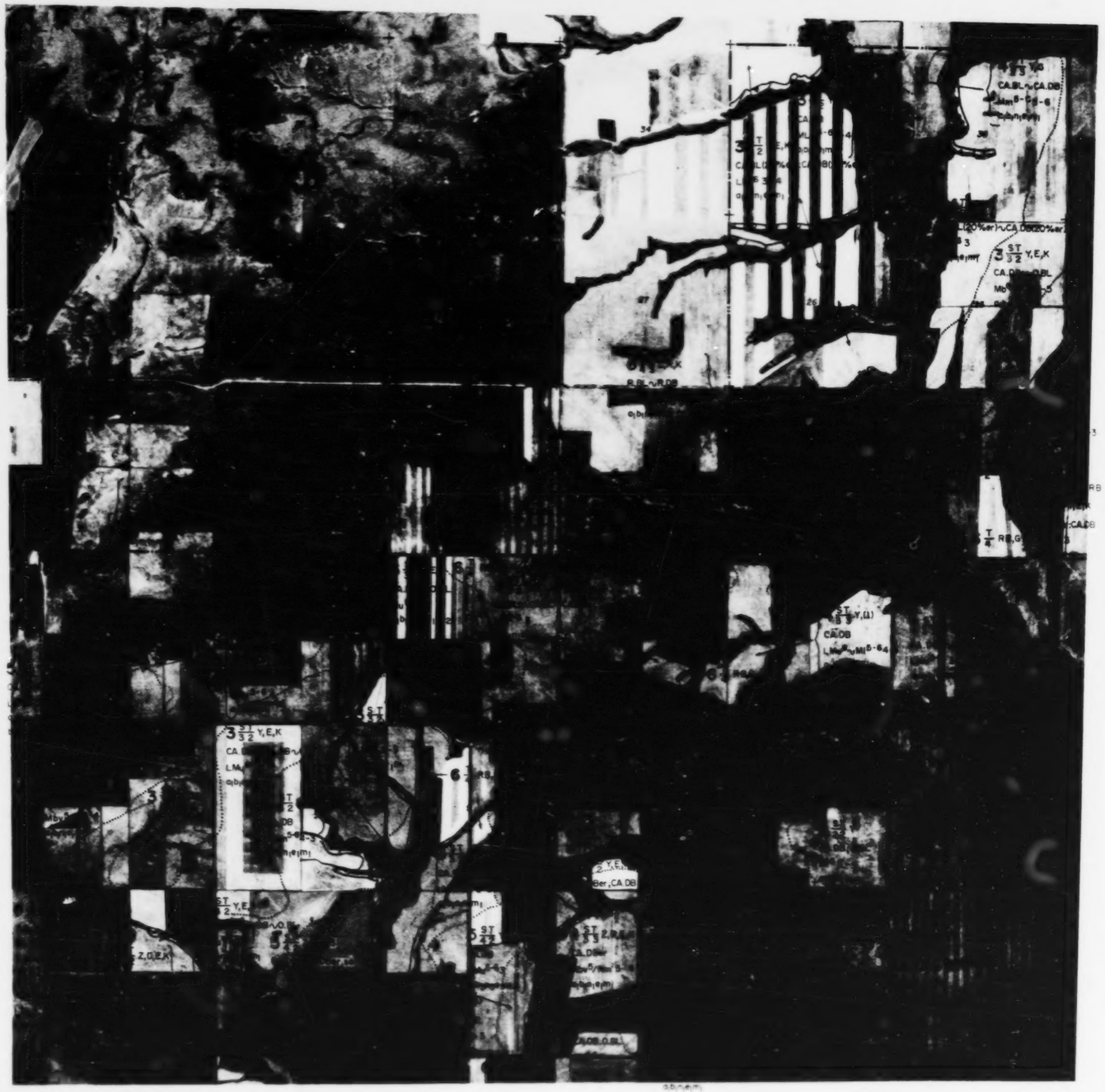
SCALE 1:40 000 | DATE 1986-03-31

SUBMITTED C.G. Heath
DATE Feb 20 1996
APPROVED Dave G. Kaukonis
DATE Feb. 26, 1996

DESIGNED ALBERTA AGRICULTURE
DRAWN A.H., D.F.

DWG. No. X-200-H2-59

SHEET 7 OF 9 | FILE No. 8876



STATISTICAL SUMMARY

LAND CLASS	Acres (hectares)		LAND CLASS	Acres (hectares)	
1	0	(0)	4	2260	(920)
2	250	(100)	5	1000	(410)
3	8310	(3360)	6	3540	(1430)

LEGEND

SOIL SYMBOL — LAND CLASS — SOIL CATEGORY — TOPOGRAPHY SYMBOL — LIMITING FACTORS — DRAINABILITY — TOPOGRAPHY CATEGORY

Soil Taxonomy — Soil Textural Class — Genetic Material — Surface Expression — Soil Phase — Slope Class — Other Factors — Soil Chemistry

LAND CLASSES

1. Excellent capability with no significant limitations for irrigation.
2. Good capability with moderate limitations for irrigation.
3. Fair capability with moderately severe limitations for irrigation.
4. Restricted capability requiring a special system design and/or special management.
5. Non-irrigable pending detailed investigation, implementation of an improvement and/or undergoing reclamation. Land within this class may be upgraded to an irrigable class or will be rated Class 6.
6. Non-irrigable.

SOIL CATEGORIES

1. Irrigable-Excellent
2. Irrigable-Good
3. Irrigable-Fair
4. Non-Irrigable

TOPOGRAPHY CATEGORIES

1. Irrigable-Gravity
2. Irrigable-Sprinkler
3. Irrigable-Special System Design
4. Non-Irrigable

DRAINABILITY

X Moderately to rapidly permeable
Y Slowly permeable
Z Relatively impermeable

SOIL LIMITATIONS

D low permeability/undesirable structure
R shallowness to bedrock
K shallow profile development
N sodicity
W excessive wetness
S salinity
M low moisture holding capacity
E erosion damage
(1) high lime/very fine texture

TOPOGRAPHY LIMITATIONS

F surface drainage
G steep slopes
J field size, shape
B brush/tree cover
RB rough broken
U earth moving
P stoniness

SOIL TAXONOMY

B Brown
DB Dark Brown
DG Dark Grey
BL Black
G Gleysol
HG Humic Gleysol
R Regosol
HR Humic Regosol
SZ Solonetz
SS Solodized Solonetz
SO Solod
O Orthic
R Rego
CA Calcareous
E Eluviated
SZ Solonetzic
GL Gleyed
CU Cumulic
A Alkaline

SOIL PHASES

alk alkaline
calc calcareous
carb carbonated
er eroded
gr gravelly
li lithic
sa saline
st stony

GENETIC MATERIAL

A Anthropogenic
C Colluvial
E Eolian
F Fluvial
L Lacustrine
M Morainal (Till)
R Bedrock
S Saprolite (Residual)
U Undifferentiated

SURFACE EXPRESSION

a apron
b blanketed
f fan
h hummocky
i inclined
l level
m rolling
r ridged
s steep
t terraced
u undulating
v veneered

TEXTURE

O Gravel
1 Sand
2 Loamy Sand
3 Sandy Loam, Fine Sandy Loam
4 Loam, Silt Loam, Very Fine Sandy Loam
5 Silty Clay Loam, Clay Loam Sandy Clay Loam
6 Silty Clay, Clay, Sandy Clay
7 Heavy Clay

SLOPE CLASS / PERCENT SLOPE / TERMINOLOGY

SLOPE CLASS	PERCENT SLOPE	TERMINOLOGY
1	0 - 0.5	Level
2	0.5 - 2	Nearly Level
3	2 - 5	Very gentle slope
4	6 - 9	Gentle slope
5	10 - 15	Moderate slope
6	16 - 30	Strong slope

DEPTH TO GROUNDWATER

CATEGORY	DEPTH (m)
W_1	>2
W_2	1-2
W_3	<1

DEPTH TO BEDROCK (R) OR SAPROLITE (S)

CATEGORY	DEPTH (m)
R_1 S_1	>3
R_2 S_2	2 - 3
R_3 S_3	1 - 2
R_4 S_4	<1

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